



# The CompactLight | XLS Project

H2020 INFRADEV - Design Study 2018 - 2020

<http://compactlight.eu>

Our aim is to facilitate the widespread development of X-ray FEL Facilities across Europe and beyond, by making their construction and operation more affordable through an optimum combination of emerging and innovative accelerator technologies



With CompactLight we plan to design  
**a Hard X-ray Facility**

using the very latest concepts for:

- High brightness electron photoinjectors
- Very high gradient accelerating structures
- Novel short period undulators.

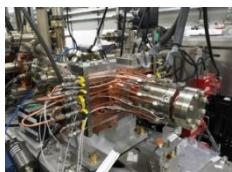
Participant	Organisation Name	Country
1	ST (Coord.) Elettra - Sincrotrone Trieste S.C.p.A.	Italy
2	CERN CERN - European Organization for Nuclear Research	International
3	STFC Science and Technology Facilities Council - Daresbury Laboratory	United Kingdom
4	SINAP Shanghai Inst. of Applied Physics, Chinese Academy of Sciences	China
5	JASA Institute of Accelerating Systems and Applications	Greece
6	UU Uppsala Universitet	Sweden
7	UoM The University of Melbourne	Australia
8	ANSTO Australian Nuclear Science and Technology Organisation	Australia
9	UA-IAT Ankara University Institute of Accelerator Technologies	Turkey
10	ULANC Lancaster University	United Kingdom
11	VDL ETG VDL Enabling Technology Group Eindhoven BV	Netherlands
12	TU/e Technische Universiteit Eindhoven	Netherlands
13	INFN Istituto Nazionale di Fisica Nucleare	Italy
14	Kyma Kyma S.r.l.	Italy
15	SAPIENZA University of Rome "La Sapienza"	Italy
16	ENEA Agenzia Naz. per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile	Italy
17	ALBA-CELLS Consorcio para la Construcción Equipamiento y Explotación del Lab. de Luz Sincrotron	Spain
18	CNRS Centre National de la Recherche Scientifique	France
19	KIT Karlsruhe Institut für Technologie	Germany
20	PSI Paul Scherrer Institut	Switzerland
21	CSIC Agencia Estatal Consejo Superior de Investigaciones Científicas	Spain
22	UH/HIP University of Helsinki - Helsinki Institute of Physics	Finland
23	VU VU University Amsterdam	Netherlands
24	USTR University of Strathclyde	United Kingdom
Third Parties	Organisation Name	Country
AP1	OSLO Universitetet i Oslo - University of Oslo	Norway
AP2	ARCNL Advanced Research Center for Nanolithography	Netherlands
AP3	NTUA National Technical University of Athens	Greece
AP4	AUEB Athens University Economics & Business	Greece

## The New Facility, compared with Current Facilities, will benefit from:

- A lower electron beam energy, due to the enhanced undulator performance
- Being significantly more compact due to lower energy and high gradient structures
- Having a much lower electrical power demand than current facilities
- Having much lower construction and running costs

### Injector Gun

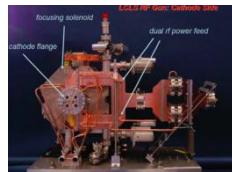
Review state of the art Gun/Injector (S, C, X band) and pick the best  
Develop a novel high rep. rate Gun/Injector with K-band linearizer



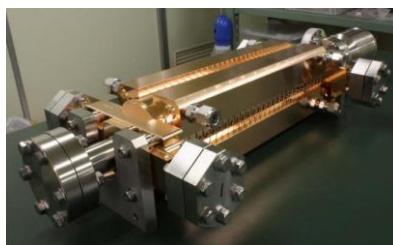
400Hz S-band Rf gun CLARA



Ultra-low emittance e- source TU/e



LCLS S-band rf gun



**CERN CLIC Accel. Struct.**  
11.994 GHz\_X-band  
100 MV/m

### Undulators and Light Production

Comparative studies of "ambitious" undulators on the timescale of 4-5 years:  
eg. cryo permanent-magnet, super-conductive undulators, ...



Cryo PM Undulator HZB/UCLA

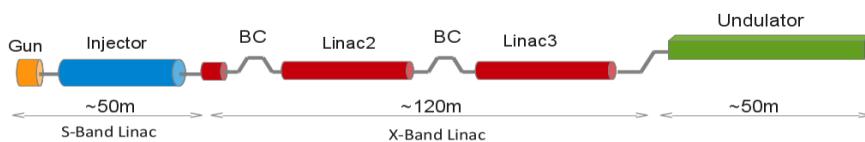


ENEA-INFN

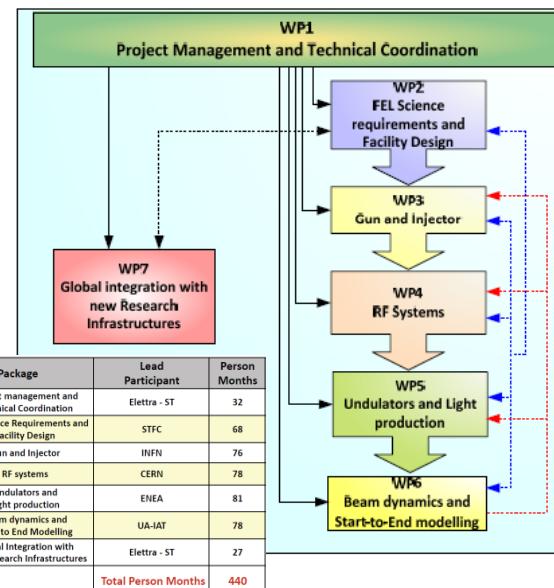


S. C. Undulator KIT

### Start-to-end Electron Beam Simulation



### CompactLight WPs Structure



Work Package	Lead Participant	Person Months
WP1	Project management and Technical Coordination	32
WP2	FEL Science Requirements and Facility Design	68
WP3	Gun and Injector	76
WP4	RF systems	78
WP5	Undulators and Light production	81
WP6	Beam dynamics and Start to End Modelling	78
WP7	Global Integration with New Research Infrastructures	27
<b>Total Person Months</b>		<b>440</b>

		LCLS	SACLA	SwissFEL (ARAMIS)	LCLS II (HXR)	PAL XFEL (HXR)	EU-XFEL (HXR)	XLS (HXR)
Min Photon Energy	KeV	0.27	5.0	1.8	1.03	2.06	3.1	0.25
Wavelength	nm	4.59	0.25	0.69	1.20	0.60	0.40	4.96
Max Photon Energy	KeV	12.4	15.5	12.4	25	20.6	25	25
Wavelength	Å	1.0	0.8	1.0	0.5	0.6	0.5	0.5
Max Pulse Energy	μJ	6000	250	150				1000
Pulse Duration	fs	2 - 100	20 - 30	20				0.1 - 50
Pulse/sec.	Hz	120	60	100	120	60	27000	100 - 1000
Beam Energy	GeV	15	8.5	5.8	15	10	17.5	TBD

